BANKNOTE ACCEPTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates to vending machines and the like and, more specifically, to a banknote acceptor for use in a vending machine or money exchanging machine, which uses ultraviolet light to verify the authenticity of the inserted banknote.

2. Description of the Related Art:

In public places, vending machines are provided to sell different items. Regular vending machines include two types, one accepting coins and the other accepting banknotes. A banknote accepting vending machine has verification means to verify the authenticity of the inserted banknote. However, conventional banknote acceptors do not use ultraviolet light to verify the ink characteristics of banknotes. Following the employment of high-tech equipment, counterfeit banknotes and genuine banknotes are quite similar in outer appearance and other several characteristics. Regular banknote acceptors may not be able to accurately verify the authenticity of banknotes.

SUMMARY OF THE INVENTION

The present invention has been accomplished under the circumstances in view. It is the main object of the present invention to provide a banknote acceptor, which uses ultraviolet light to

verify the authenticity of the inserted banknote.

According to the present invention, the banknote acceptor comprises a housing, the housing comprising an insertion slot in a face panel thereof for receiving banknote, and a conveying and banknote holding down mechanism; a money box mounted in the housing and adapted to collect banknote from the insertion slot; and a banknote verification assembly mounted in the housing and adapted to verify the authenticity of the inserted banknote, for enabling the verified banknote to be delivered to the inside of the money box by the conveying and banknote holding down mechanism; wherein the banknote verification assembly comprises a transmitter holder base, the transmitter holder base having a detection side; a receiver holder base, the receiver holder base having a detection side facing the detection side of the transmitter holder base; a banknote passage defined between the detection side of the transmitter holder base and the detection side of the receiver holder base in communication between the insertion slot and the money box; an optical transmitter module mounted in the detection side of the transmitter holder base, the optical transmitter module comprising at least one ultraviolet light emitting diode adapted to emit ultraviolet light onto the banknote being delivered from the insertion slot through the banknote passage; an optical receiver module mounted in the detection side of the receiver holder base,

the optical receiver module comprising at least one photo transistor adapted to receive light passing from the optical transmitter module through the banknote being delivered from the insertion slot through the banknote passage and to produce a corresponding output signal; and a control unit adapted to receive outputted signal from the optical receiver module and to determine the authenticity of the banknote being delivered from the insertion slot through the banknote passage subject to the output signal received from the optical receiver module.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded view of a banknote acceptor according to the present invention.

FIG. 1A is a side view in section of the banknote acceptor according to the present invention.

FIG. 2 is a circuit block diagram of the present invention.

FIG. 3 is a circuit diagram of the optical transmitter module and the optical receiver module according to the present invention.

FIG. 4 is a detailed circuit diagram of the optical transmitter module according to the present invention.

FIG. 5 is a detailed circuit diagram of the optical receiver module according to the present invention.

FIG. 6A is a circuit diagram of the control unit according to the present invention (I).

FIG. 6B is a circuit diagram of the control unit according to the present invention (II).

FIG. 6C is a circuit diagram of the control unit according to the present invention (III).

FIG. 6D is a circuit diagram of the control unit according to the present invention (IV).

FIG. 7 is a circuit diagram of the power module according to the present invention.

FIG. 8A is a circuit diagram of the communication interface module according to the present invention (I).

FIG. 8B is a circuit diagram of the communication interface module according to the present invention (II).

FIG. 9 is a circuit diagram of the transmission module according to the present invention.

FIG. 10 is an operation flow of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 1A, a banknote acceptor is shown comprised of a housing **1**, a money box **2**, and a banknote verification assembly **3**.

The housing **1** is provided with a face panel **11**, which has an insertion slot **111** through which a banknote is inserted into the banknote verification assembly **3**. The money box **2** and the banknote verification assembly **3** are mounted in the housing **1** at

different elevations. The banknote verification assembly **3** is adapted to verify the authenticity of the inserted banknote, for enabling the verified banknote to be delivered to the inside of the money box **2** by a conveying and banknote holding down mechanism (not shown) in the housing **1**.

Referring to FIG. 2 and FIGS. 1 and 1A again, the banknote verification assembly **3** comprises a transmitter holder base **31**, a receiver holder base **32**, an optical transmitter module **33** (see also FIGS. 3 and 4), an optical receiver module **34** (see also FIGS. 3 and 5), a control unit **35** (see also FIGS. 6A, 6B, 6C, and 6D), a power module **36** (see also FIG. 7), a communication interface module **37** (see also FIGS. 8A and 8B), and a transmission module **38** (see also FIG. 9). The optical transmitter module **33** is mounted in the detection side **311** of the transmitter holder base **31**. The optical receiver module **34** is mounted in the detection side **321** of the receiver holder base **32**. The detection side **311** and **321** face each other, defining therebetween a banknote passage **39**. The optical transmitter module **33** comprises at least one UV LED (ultraviolet light emitting diode) **331**. The optical receiver module **34** comprises at least one phototransistor **341** matching the UV LED **331**. The UV light of the UV LED **331** passes through the banknote passage **39** to the phototransistor **341**. Therefore, when a banknote moved through the banknote passage **39**, the UV light of the UV

LED **331** passes through the banknote to excite the fluorescent substance in the inks of the banknote, thereby causing the photo transistor **341** to receive a fluorescent signal and then to send the signal to the control unit **35** for verifying the authenticity of the banknote.

Referring to FIGS. 1, 1A, 2 and 3 again, the power module **36** is adapted to convert external power supply into the desired working voltage for the optical transmitter module **33**, the optical receiver module **34**, the control unit **35**, the communication interface module **37**, and the transmission module **38**. The communication interface module **37** is connectable to a main unit (not shown). The main unit (which can be a computer, money exchanging machine, or vending machine) controls the operation mode of the control unit **35**. The transmission module **38** is installed in the conveying and banknote holding down mechanism inside the housing **1** for enabling the banknote to be delivered through the banknote passage **39** to the money box **2**.

Referring to FIG. 3 again, the optical transmitter module **33** further comprises a NPN transistor **332** and a current-limit resistor **333**. The base of the transistor **332** is connected to the control unit **35**. The collector of the transistor **332** is connected to the UV LED **331**. The emitter of the transistor **332** is connected to the current-limit resistor **333**. The other end of the current-limit

resistor **333** is connected to a grounding loop **334**. By means of the transistor **332** and the current-limit resistor **333**, the control unit **35** controls the amount of electric current to the UV LED **331**, determining the intensity of UV light.

Referring to FIG. 3 again, the optical receiver module **34** further comprises a shunt resistor **342**, which has one end connected to the phototransistor **341** and the control unit **35** and the other end connected to the grounding loop **343**. The shunt resistor **342** controls the phototransistor **341** to regulate output voltage and to transmit the detected fluorescent signal to the control unit **35**.

Referring to FIG. 10, when the banknote verification assembly **3** starting to verify the authenticity of the inserted banknote, the control unit **35** proceeds subject to the following steps:

(401) initializing the system;

(402) determining if there is a banknote to be verified or not? And then proceeding to step (403) if positive, or repeating step (402) if negative;

(403) receiving the inserted banknote and reading the fluorescent characteristics of the banknote;

(404) determining the authenticity of the banknote subject to the detected fluorescent characteristics, and then proceeding to step (405) if positive or step (406) if negative;

(405) delivering the banknote to the money box and sending a receiving signal, and then repeating step (402); and

(406) returning the banknote, and then repeating step (402).

A prototype of banknote acceptor has been constructed with the features of FIGS. 1~10. The banknote acceptor functions smoothly to provide all of the features discussed earlier.

Although a particular embodiment of the invention has been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the invention. Accordingly, the invention is not to be limited except as by the appended claims.